

Vol. 91 No. 240

April 1974

THE
NATIONAL GEOGRAPHIC MAGAZINE

WEATHER MAKING, ANCIENT AND MODERN

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WASHINGTON

Published by the National Geographic Society

Price \$3.00

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BY
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The subject of ancient and modern weather making is a very large one—too large to be treated with entire generality. I shall discuss it rather from the American standpoint, and shall now cross in the Old World simply for the purpose of illustration and for completeness.

Three distinct sorts of weather-making have been employed. The first depends on superstitious and religious methods; then follows on this the degradation of these religious ideas into folk-lore remnants, which have a curious persistency in civilized countries. Both these are psychic. Opposed to them is the third method, mainly American and intensely practical, with which some history and literature are connected.

I. SUPERSTITIONS AND HUMOROUS METHODS.

*RAIN MAKING AND STOPPING.**

Many Indian tribes have attempted to produce rainy or dry weather, according to requirements. Among these may be mentioned the Mandan, the Muskogean, the Moqui, the Natchez,

* These cases of weather making among the North American Indians were collected for me by Dr Fuller Walker, of the Weather Bureau, who searched through the literature available in Washington.

Zuni, Choctaw, and others. For this purpose pipes were smoked, tobacco was burned, prayers and incantations were offered, arrows were discharged toward the clouds, charms were used, and various other methods were employed. Classifying by tribes the processes employed, we turn first to the Iroquois.

Mrs E. A. Smith, in her "Myths of the Iroquois," says:

In a dry season, the horizon being filled with distant thunder-bombs, it was customary to burn what is called by the Indians real tobacco as an offering to bring rain.

On occasions of this nature the people were notified by swift-footed messengers that the children, or sons, of Thunder were in the horizon, and that tobacco must be burned in order to get some rain.*

As to the Muskingum, Hockewelder, in his "Account of the Indians of Pennsylvania" (Philadelphia, 1810, page 229), says:

There are jugglers, generally old men and women, who get their living by pretending to bring down rain when wanted, and to import good luck to bad hunters. In the summer of 1796 a most uncommon drought happened in the Muskingum country (Ohio). An old man was applied to by the women to bring down rain, and, after various ceremonies, declared that they should have rain enough. The sky had been clear for nearly five weeks, and was equally clear when the Indian made his declaration; but about four o'clock in the afternoon the horizon became overcast, and, without any thunder or wind, it began to rain, and continued to do so until the ground became thoroughly soaked.

Hockewelder adds that "Experience had doubtless taught the juggler to observe that certain signs in the sky and in the water were the forerunners of rain."

Among the Natchez, according to Father Charlevoix,† jugglers not only pretended to cure the sick, but also professed to procure rain and seasons favorable for the fruits of the earth. Their incantations were often directed to the dispersion of clouds and the expulsion of evil spirits from the bodies of the afflicted.

In the third report of the Bureau of Ethnology it is stated by J. Owen Dorsey that "When the first thunder is heard in the spring of the year the Elk people [among the Omaha Indians] call to their servants, the Bear people, who proceed to the sacred tent of the Elk gens. When the Bear people arrive one of them opens the sacred bag and, after removing the sacred pipe, hands it to one of the Elk men, with some of the tobacco from the elk

* 2d Ann. Rep. Bureau of Ethnology for 1880-'81 (1887), p. 72.

† Voyage to North America, Dublin, 1758, vol. II, p. 282.

bladder. Before the pipe is smoked it is held toward the sky, and the thunder god is addressed. * * * 'At the conclusion of this ceremony the rain always ceases, and the Bear people return to their homes.' * *

Catlin, in his "Life among the Indians" (page 78), says that he found that the Mandan had "rain-makers" and also "rain-stoppers," who were respected medicine men. "From the astonishing facts of their having made it rain in an extraordinary drought, and for having stopped it raining when the rain was continuing to an inconvenient length." He adds:

For this purpose, in a very dry time, the medicine men assembled in the medicine lodge, and sitting around a fire in the center, from day to day smoking and praying to the Great Spirit for rain, while a separate number of young men volunteered to make it rain. Each one of these, by himself, takes his turn to mount to the top of the wigwags at sunrise in the morning, with his bow and arrows in his hand and shield on his arm, talking to the clouds and asking for rain, or ranting and threatening the clouds with his bow, compelling it to rain. After several days of unsuccessful attempts have passed off in this way with a clear sky, some one more lucky than the rest happens to take his stand on a day on which a black cloud will be seen moving up. When he sees the rain actually falling he lets his arrow fly, and pointing says: "There! my friends, you have seen my arrow go. There is a hole in that cloud. We shall soon have rain enough." When he comes down he is a medicine man. The doctors give him a feast and a great recovery and the doctor's wife. When the doctors commence rain-making they never fail to succeed, for they keep up the ceremony until the rain begins to fall. Those who have once succeeded in making it rain, in the presence of the whole village, never undertake it a second time. They would rather give other young men a chance.

A similar account of the Mandan ceremony is given by Mr. John Frost, in his book "The Indians of North America" (New York, 1845, page 199). He says:

It was in a time of great drought that I once arrived at the Mandan village on the upper Missouri. The young and the old were crying out that they should have no green corn. After a day or two the sky grew a little cloudy to the west, when the medicine men assembled together in great haste to make it rain. The tops of the wigwags were soon crowded. In the mystery lodge a fire was kindled, around which sat the rain-makers, burning sweet-smelling herbs, smoking the medicine pipe and calling on the Great Spirit to open the door of the skies to let out the

* "Omaha Sociology," op. cit., 1884, p. 227.

rain. At last one of the rain-makers came out of the mystery lodge and stood on the top of it with a spear in his hand, which he brandished about in a commanding and threatening manner, lifting it up as though he were about to hurl it at the listeners. He talked loud of the power of his medicine, holding up his medicine bag in one hand and his spear in the other; but it was of no use, and he came down in disgrace. For several days the same ceremony continued, until a rain-maker, with a head-dress of the skins of beaver, ascended the top of the mystery lodge, with a bow in his hand and a quiver at his back. He made a long speech, for the sky was growing dark, and it required no great knowledge of the weather to foretell rain. He shot arrows to the starlike and starbed points of the heavens, and also to the north and south, in honor of the Great Spirit, who could send rain from all parts of the sky. A full arrow he retained until it was almost certain that rain was at hand. Then, sending up the shaft from his bow with all his might, to make a hole in the dark cloud over his head, he cried aloud for the waters to pour down at his bidding and to drench him in the skin. He was brandishing his bow in one hand and his medicine in the other, when the rain came down in torrents.

Among the Blackfoot Indians, according to W. P. Clark in his "*Indian Sign Language*" (Philadelphia, 1885, page 72):

The medicine man has a separate lodge, which faces the east. He fasts and dances to the sun, blowing his whistle. He is painted in different colors, and he must have no water, and only after dark can he eat, and then only the inner bark of the cotton-wood tree. A picture of the sun is painted on his forehead; the moon, stars, etc., on his body. The dance continues for four days, and should the medicine man think it is sure to cause rain, and if it [does not] make an other exhibition of his weakness is wanted or taken. He is deposed as high priest at once.

Mr W. Noble of Indian territory says that "The Choctaws, during a severe drought, will fasten a fish to one of their number, who then goes into the water and remains there every day for two weeks in order to cause it to rain." He adds that "In wet weather, if they wish the rain to cease, they go to a mud bank, put sand in a pan, and dry it over a fire."

Among the Hopis, according to Schillerath:

There is a charm used for calling down rain. It consists of a small quantity of wild honey wrapped up in the inner fold of the bark of the mulberry. To produce the effect desired it is necessary to take a piece of the stick which contained the wild honey, chew it and spit it upon the ground which needs the rain.*

* "*History*," *etc.*, vol. III, p. 298.

Captain J. G. Bourke, in his "*Snake Dance of the Moqui*" (page 120) says:

There was painted on the east wall a cyclolical design, or "prayer," representing three rows of clouds in red and blue, from which descended long narrow black and white stripes, typical of rain, while from right and left issued long red and blue streaks, emblematic of lightning. This was a prayer to the god of clouds to send refreshing rains upon the Moqui crops. * * * Yellow was used in all prayers for serenity, green for war, and red for passion.

Among the Zuni, according to Sternsman, medicine sticks were supposed to influence rain. These little sticks are found hidden beneath the rafters of nearly every house in Zuni.*

Passing a little further from house we find, in Acosta's "*History of the Indies*,"† some accounts of rain producing and weather making among the Peruvian natives. According to him a Peruvian king in his lifetime caused a figure to be made wherein he was represented, which they called *Huayno*, which signifies brother. They carried this image to the wars and in procession for rain or fair weather, making stately feasts and sacrifices to it. They also pursued other methods. "In matters of importance they offered up alpacas, hanging the head by the right fore-leg, turning his eyes to the sky, speaking certain words according to the quality of the sacrifice they slew; for if it were of color their words were addressed to the god of thunder and lightning, that they might want no water" (page 341). If they wanted water, to procure rain they set a black sheep tied in the middle of a plain, pouring much chicha about it, and giving it nothing to eat until it rained (page 376). This is practiced (says Acosta, 1571-1588), at this day in many places in the month of October.

OTHER WEATHER MAKING.

What processes relate to rain making or stopping. A somewhat similar series of facts occur among the American Indians concerning other elements of the weather, but their energies in this direction seem to be expended chiefly in the control of the winds.

It appears that the Kanakas gods of the Oaiaha are Wind people, and to them is especially entrusted the control of the

* *El Ann. Rep. Bureau of Ethnology*, p. 371.

† Hakluyt Society edition, vol. II, pp. 312-313.

wind. Mr J. Owen Dorsey says the Katoze (Katoa or Kaw) goes of the Omaha tribe, being Wind people, "Bap their blankets to start a breeze." * He adds that when there is a blizzard the other Katoa tribe of Indian territory beg the members of the Wind gens to interpose, saying, "O grandfather, I wish good weather. Cause one of your children to be desecrated." Then the youngest son of a Katoa man, say one about four feet high, is chosen for the purpose, and painted with red paint. The youth rolls over and over in the snow, rolling it for some distance all around him. This is supposed to stop the blizzard.

The following account is from a book entitled "The Fourteen Iowa Indians" (London, 1844), and relates to raising wind :

A pocket ship, with Indians on board, was becalmed for several days near the English coast. It was decided to call upon the medicine man to try the efficacy of his magical powers with the endeavor to raise the wind. After the usual ceremony of a mystery feast, and various incantations to the spirit of the wind and ocean, both were consulted by the sacrifice of many plugs of tobacco thrown into the sea; and in a little time the wind began to blow, the sails were filled, and the vessel was wafted into port.

The Indians also have many associations with thunder. Madam Lamy Elliot Kocher, in a paper recently contributed to the "American Agriculturist" for December, 1892, says:

The Delawares used to have a company of men who claimed the exclusive power and privilege of fighting the thunder. Whenever a storm which they wished to avert threatened, the thunder fighters would take their bows and arrows, their magic drum, and a sort of whistle made of the wing-bone of a war eagle, and, thus armed, run out and fire at the rising cloud, whooping, yelling, whistling and beating their drum to frighten it down again. One afternoon a heavy black cloud came up, and they repaired to the top of a hill, where they brought all their magic artillery into play against it; but the unflinching thunder darted out a bright flash which struck one of the party dead as he was in the very act of striking the fire-pointed lance against it. After that they decided that no human power could quell the thunder.

In the "Pawnee Hero Stories and Folk-tales," published by George Bird Grinnell, we find the following :

An old Pawnee Indian said: "Up north, where we worshipped at the time of the first thunder, we never had cyclones. Down here [Indian territory], now that this worship has been given up, we have them."

* See Ann. Rep. Bureau of Ethnology, p. 231.

The Indians in some cases have ideas of controlling the weather more generally, and Dobbin, in his "Relation of the Voyages, Discoveries and Death of Father James Macqueth,"²⁸ writing in 1671-1675, says:

It now only remains for us to speak of the calumet, then which there is nothing among the Indians (i. e., the Illinois) more mysterious or more esteemed. * * * They esteem it particularly because they regard it as the calumet of the sun, and, in fact, they present it to him to smoke when they wish to obtain calm or rain or fair weather.

Even the control of fog has been attempted, as shown by the following quotation from Dorsey's account of the Turtle subgens of the Omaha:²⁹

In the time of a fog the men of this subgens drew the figure of a turtle on the ground with its feet to the south. On the head, tail, neck, etc. of the back and on each leg were placed small pieces of a red breech-cloth with some tobacco. This they imagined would make the fog disappear very soon.

But it is not only the pagan Indians who have tried their hand at weather-making. Their christianized descendants have also tried to control these operations of nature. In the transition times between paganism and Christianity occurred some events which throw a curious and instructive side-light on this question, and two of these I will now give.

Mr Parkman says that while the Jesuits labored with the Hurons a severe draught came upon the fields. The sorcerers put forth their utmost power, and from the tops of the houses yelled incessant invocations to the spirits. All was in vain. A renowned "rain-maker," seeing his reputation tottering under his repeated failures, belighted him of accusing the Jesuits, and gave out that the red color of the cross which stood before their house scared away the bird of thunder and caused him to fly another way. On this a clamor arose. The populace turned against the priests, and the obnoxious cross was condemned to be cut down. The Jesuits said: "If the red color of the cross frightens the bird of thunder, paint it white." This was done, but the clouds still kept aloof. The Jesuits followed up their advantage. "Your spirits cannot help you. Now ask the aid of Ilou who made the world." Heavy rain occurring soon

²⁸ Hist. Coll. of Louisiana, part iv, 1892, pp. 24-25.

²⁹ 3d Ann. Rep. Bureau of Ethnology, p. 240.

after, it is said that many Indians believed in the white man's Great Spirit and presented themselves to the priests for baptism (Allen Elliot Koster).

A somewhat similar story is told of Peru by Arista. It appears that the Santa Cruz Indians became Christians because of the success of a renegade soldier in making rain. This soldier, seeing the native Indians "in a great extremity for water, and that to procure rain they used many superstitious ceremonies, according to their usual manner," said to them that if they would do as he said they should presently have rain, which they willingly offered to perform. "Then the soldier made a great cross, which he placed on a high and eminent place, commanding them to worship it and to demand water, which they did. A wonderful thing to see, there presently fell such an abundance of rain, as the Indians took so great devotion to the holy cross as they tied unto it in all their necessities, and obtained all they demanded, so as they broke down their idols."²

The quotation from Arista indicates the attitude of the Indians of middle latitudes on this subject. This attitude, as is well known to those familiar with the Latin-American countries, is preserved unchanged among their descendants. Interesting illustrations of it can be picked up any day even as far north as Arizona and New Mexico, and every traveller in Latin-America has several at his disposal. As the quintessence of them all I present a clipping from the *New York Tribune* to which my attention was called by Dr T. C. Mendenhall. *See how I cross I have trouble*. The extract runs as follows:

In the department of Cuzco there had been no rain for nearly a year, and the people were brought to such a pass that they were actually dying of thirst, to say nothing of the total destruction of all crops and other agricultural industries.

"El Pueblo Católico," of New San Salvador, prints a number of resolutions promulgated by the principal alcalde of the town and department of Cuzco. They are as follows:

"Considering that the Supreme Creator has not behaved well in this province, as in the whole of last year only one shower of rain fell; that in this summer, notwithstanding all the processions, prayers and praises, it has not rained at all, and consequently the crops of Cuzco, on which depend the prosperity of the whole department, are entirely ruined, it is decreed:

"Article 1. If within the peremptory period of eight days from the

² *Op. cit.*, vol. II, p. 524.

The document does not mention or allude to the fact that the author, and who can be considered as a "Militant Leader," from past experience & right has about the 1950's, to the present time, had

[illegible]

The electrical resistance was measured with the weather proofing. The switches were the same as the ones that would be used for the weather proofing of the switches.

Still, many have not thought of $\text{H}^1(X, \mathbb{Z})$ as important. For example, Loomis [12, Ch. 1] writes, "The vector spaces $\text{H}^1(X, \mathbb{R})$ and $\text{H}^1(X, \mathbb{C})$ are the only ones which carry a natural inner product, while every higher order cohomology space with a complex structure has a natural Hermitian inner product, and we shall assume, without loss of generality, that $\text{H}^1(X, \mathbb{C})$ is the \mathbb{C} -linear span of $\text{H}^1(X, \mathbb{R})$." In this paper,

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What you are so anxious to justify is a very poor kind of critical thing, it was the fault of a committee. There are some who have tried to do better than that. The spirit of Jacques-Lafontaine is in the air the same time as you are in it, and a series of books. I have great respect for all such efforts, and I find printed books in book stores to be the price of what I can see here about papers and stones, and a great deal of the same is in the air. What is it now as a history of it? It is a history of the printed word, in which you are engaged. I am afraid you have not a respect for the respect of the people of the nation and the correctness of his life. He is a person who has got out of the world a public, a great one, but he was a paradoxer very much concerned in the whole work of his time. He was a man who was a paradoxer to his people, perhaps even now, and was a paradoxer to the nation and of his day.

[illegible]

[illegible]

1990年11月，在江蘇省江浦縣江浦鎮，發現了迄今為止中國最大的新石器時代的城址——明龍崗遺址。該城址位於江浦縣城西北約10公里處，佔地約100公頃。城址呈長方形，南北長約1.5公里，東西寬約1公里。城牆由夯土築成，高約2米，寬約10米。城內有大量的房屋基址、墓葬、窖穴等遺跡。此外，還發現了大量的陶器、石器、骨器等文物。明龍崗遺址的發現，為研究新石器時代的城址提供了重要的實物資料。

we produced a film about the great discovery and the life of Albert Einstein (written by Hermann J. Frankel). In 1950, when we were preparing a film for the children's production, as the subject was a story of a very rare and exceptional phenomenon, namely that of a genius, I wrote about

As a percentage of total sales, the average amount of debt financing obtained by the firm is approximately equal to that of nonfinancially distressed firms. However, the amount of debt is much smaller, as a result of the smaller size of the firms. The average size of the debt is also smaller, as a result of the smaller size of the firms. The average size of the debt is also smaller, as a result of the smaller size of the firms.

[illegible]

Thus, for example, a person who is 100 years old and has a life expectancy of 10 years is expected to survive for an additional 100 years, which implies that he will not die before 200. This counterfactual result is apparent in the graph in Figure 1, where the probability of dying is zero for all ages greater than 100. In the case of Figure 2, the probability of dying is zero for all ages greater than 100, but the probability of dying is positive for ages less than 100, which means that people are expected to die before 100.

the 12 players in Moscow had a collective 17 months' experience of life in the front and 36 months' experience of life in the rear. It was their collective experience, as pointed out by the speaker, that was to be the basis for the work of the first part of the course.

[illegible]

But as the country was so heavily in debt, it was necessary to get rid of the debt. It was decided to sell the land to the United States. The land was sold to the United States for \$1.50 million. The land was sold to the United States for \$1.50 million. The land was sold to the United States for \$1.50 million.

The old House of Commons represented a kind of middle ground between the two extremes of the old House of Commons, and the House of Commons of 1793. The House of Commons of 1793 was a kind of middle ground between the two extremes of the old House of Commons, and the House of Commons of 1793.

It would appear that the fact that the β phase is a single crystal structure in contrast to the polycrystalline nature of the α phase may be responsible for the observed differences in the rate of decomposition. It is known that the kinetics of decomposition are greatly influenced by the initial physical form of the material. The rate of decomposition of a single crystal is much slower than that of a polycrystalline material. This is due to the fact that the rate of decomposition is controlled by the rate of diffusion of the decomposition products out of the material. In a single crystal, the diffusion path is much longer than in a polycrystalline material, where the grain boundaries provide a much shorter diffusion path. This is why the β phase, which is a single crystal, decomposes much more slowly than the α phase, which is a polycrystalline material.

The Department has been in the process of conducting a study of the impact of the proposed changes on the public. The study is currently in progress and will be completed by the end of the year. The results of the study will be used to inform the public and to guide the implementation of the changes.

Mr. Cantabrigia, on a small but little book, entitled, "Science and Religion," and written originally by George Newman, and now edited by Alfred Russel Wallace, and Professor Huxley, in the "Library of Theological Science." In this work we learn that the Catholic Church has long recognized the necessity of religious education, and was led to have recourse to the study of the sciences, and was led to have recourse to the study of the sciences, and was led to have recourse to the study of the sciences.

1. The first part of the paper is devoted to the study of the asymptotic behavior of the solutions of the system (1) as $\epsilon \rightarrow 0$. It is shown that the solutions of the system (1) converge to the solutions of the system (2) as $\epsilon \rightarrow 0$.

[illegible]

When the 1990s had been a decade of economic growth, the 2000s were a decade of economic stagnation. The United States had been the world's largest economy for decades, but its growth had slowed to a crawl. The economy had been in a state of "stagnation" for a decade, and the government had been unable to do anything about it. The economy had been in a state of "stagnation" for a decade, and the government had been unable to do anything about it.

[illegible]

I am writing to you to help you understand that you are not alone. We are all in this together, and we will get through this. I am writing to you to help you understand that you are not alone. We are all in this together, and we will get through this.

[illegible]

[illegible][illegible]

4. The authors of the paper are not aware of the fact that the results of the study are not consistent with the results of the study by [10] and [11]. The authors of the paper are not aware of the fact that the results of the study are not consistent with the results of the study by [10] and [11].

but a 10 percent increase in the average value of the index of the number of children per woman of the system. And the next school or medium term plan for the next decade will be a 10 percent increase in the number of children per woman of the system. The next school or medium term plan for the next decade will be a 10 percent increase in the number of children per woman of the system.

As a result, the authors found that the perceived value of the service was positively affected by the perceived quality of the service. The perceived value of the service was positively affected by the perceived quality of the service. The perceived value of the service was positively affected by the perceived quality of the service.

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As the 1970s drew to a close, the industry was still in a state of flux. The 1970s had seen a number of significant changes in the industry, including the introduction of the 1970s and the 1970s. The 1970s had seen a number of significant changes in the industry, including the introduction of the 1970s and the 1970s. The 1970s had seen a number of significant changes in the industry, including the introduction of the 1970s and the 1970s.

It is not possible to make a general statement about the effect of the different types of information on the different types of information. The effect of the different types of information on the different types of information is not the same. The effect of the different types of information on the different types of information is not the same. The effect of the different types of information on the different types of information is not the same.

1979-80. 1980-81. 1981-82.

[illegible]

It is important to understand that the above information is not intended to be used as a basis for making any investment decision. It is only for informational purposes.

* The following table shows the number of persons in the population of the United States, by age and sex, in 1950 and 1955.

[illegible]

The second step is to create a separate step-by-step plan for the new
 activity. This plan should include a list of steps, a timeline, and a
 list of resources. The plan should be realistic and achievable, and it
 should be updated as needed. The plan should also include a list of
 potential obstacles and a list of strategies to overcome them.

It is thought that the two expeditions to the Texas coast have been very profitable to science, especially in the collection of birds. The birds of the Texas coast have been collected by the two expeditions, and the results of the collection are being published. The birds of the Texas coast have been collected by the two expeditions, and the results of the collection are being published. The birds of the Texas coast have been collected by the two expeditions, and the results of the collection are being published.

[illegible][illegible]

no. 1. A thin, wet, network of sponge texture is about the
consistency of paper. If the water is added well to the
L or M I you obtain a soft, porous, spongy mass, not
entirely uniform, but so fine and well formed that it
may be used for the same purposes as the other two. It
will be a great deal better than very coarse, but not so good
as the other two for the same purposes. It is a full of water.

12. We will compare a model of carbon trade with a model of carbon tax. The latter may have been used in the past with a number of assumptions that are not fully realistic.

U.S. Attorney General Eric Holder said that the Justice Department is "not aware of any evidence" that the FBI is involved in the case.

[illegible][illegible]

- CATONNA, Louis. Rain produced at Wall: 8°, Chicago, 1891: 61 pp.
- GIACCA, L. La Guerra e la Meteorologia. Considerazioni intorno agli effetti della guerra dell'artiglieria e della fanteria sullo stato dell'atmosfera: 4°, Roma, 1871.
- GUER, P. Faut-il tirer le Canon pour avoir de la Pluie? *Sci. pour Tous*, Paris, t. xvii, 1872, pp. 256-259, 241.
- HARRIS, H. A. The Production of Rain: Report Maryland State Weather Service, 1892, vol. II, pp. 80-76.
- Rain-making: *Sci. Amer.*, New York, October 31, 1891, p. 277.
- HAYWARD, C. C. Weather in War: *Atlantic Mon.*, Boston, May, 1892, pp. 303-304.
- HUMPHREY, ROWEN J. Artificial Rain-making: *Joint Franklin Inst.*, Philadelphia, vol. cxcvii, 1891 (October), pp. 308-315; *Sci. Amer. Suppl.*, number 824, October 17, 1891, p. 1166.
- Artificial Production of Rain: *Science*, Cambridge, vol. III, 1884, p. 276; *La Nature*, Athens, vol. 1, 1884, p. 25.
- LACOURT, J. K. Can Weather be influenced by artificial Means? *Nature*, London, vol. III, 1870-71, pp. 306-307.
- LE MAOUT, CHARLES. Exposé de la Doctrine des Condensation (Artificial production of rain): 8°, Saint-Brieuc, 1866: 17 pp.
- Effets du Canon et du Son des Cloches sur l'Atmosphère: 8°, Saint-Brieuc, 1869: 13 pp.
- Le Canon et la Pluie: 8°, Saint-Brieuc, 1870: 9 pp.
- Canons, Torpilles et Tempêtes: 8°, Cherbourg, 1891: 6 pp.
- Lettre adressée par Charles Le Maout au "Petit Journal," le 23 Février, 1887. *Météorologie* (Artificial production of rain): 8°, Cherbourg, 1891: 6 pp.
- LE MAOUT, ÉMILE. Lettre à M. Tremblay sur les Moyens proposés pour faire cesser la Sécheresse des six premiers Mois de l'Année, 1870, 8°, p. 6 (1891): 16 pp.
- LEWIS, J. C. Rain following the Discharge of Ordnance (note to the National Intelligencer, July 25, 1861): *Amer. Journ. Sci.*, New Haven, vol. xxvii, 1861, p. 206; *Potomac's Mith.*, Götting, 1862, p. 143.
- MACHOLAND, AUGUSTUS. On Rain-making (December 11, 1892): *Trans. Texas Acad. Sci.*, Austin, vol. 1, 1892-93, pp. 70-80.
- NEWS (THE). Rain-makers and Science: *The Nation*, Oct. 1, 1891, p. 251. Newborn, Stuart. See Dymondell.
- NEWS, ISAAC F. The weather Map and the Rain-makers: 8°, Washington, 1892: 46 pp.
- Ob. die Blitzelektre Gewitter und Regen vermindern und demnach Dürre verursachen können: *Schles. Prov.-Bl.*, Breslau, 1793, number 1.
- On great meteorological Changes which have followed violent Eruptions in War: *Quart. Journal Sci.*, London, vol. viii, 1874, p. 126.
- PROCHA, J. E. Connection entre le Nombre des Inondations et celui du Jour de Pluie dans le canton de Vaud, pendant la Période de 1830 à 1894: *Bull. Soc. Vaud.*, Lausanne, t. iv, 1896-98, pp. 157-189.
- PURCE, T. H. Rain after Fire: *Nature*, London, vol. vi, 1872, p. 121.

- Twiss, E. W. *How and How Not to Weather, or the Artificial Production of Rain*: 12°, Chicago, 1871; 171 pp.; 2d ed., revised, 12°, Delavan, Wisconsin, 1880, 202 pp.
- Should the rainfall Experiments be continued? A criticism of Professor Simon Newcomb's contribution to the article in the *North American Review* for October, 1891, entitled "Can we make it Rain?" 12°, Delavan, Wisconsin, 1892, 15 pp.
- Rain-making: *Science*, New York, vol. xix, 1892, pp. 32-33.
- Production of Rain by Human Agency*: *Sci. Amer. Suppl.*, New York, vol. 51, 1877, p. 1970.
- Rain-makers in India*: *Sci. Amer. Suppl.*, New York, October 17, 1892.
- Rain-making*: *Symon's Met. Mag.*, London, vol. xxvi, 1901, pp. 154-157.
- Romer, G. A. *On the Production of Rain at Will*: *Baldner*, London, 1880, pp. 293, 298.
- *Artificial Action and Precipitation of Rain*: 8°, Oxford, 1883. Privately printed.
- ROODER, DEXTER. *New Method of precipitating Rainfalls*: *Sci. Amer.*, New York, vol. xliii, 1893, pp. 196, 342; *Les Maudes*, Paris, U. S., 1890, pp. 80-81; *Année Sci. Indus.*, Paris, t. xiv, 1889, pp. 69-71; *Cronica Cient.*, Barcelona, vol. ix, 1881, pp. 33-34.
- *Method of precipitating Rainfalls*: United States patent number 210,067, July 13, 1899; 2 pp., 3 pls.
- Rosenthal, HENRI. *Rain produced by Fire*: *Nature*, London, vol. 36, 1870-71, p. 248.
- SCHNEIDER, PAUL. *Ueber die in Neudammeln angestellten Versuche zur künstlichen Erzeugung von Regen*. (A lecture before the Saxon Economic Society, February 10, 1896; *Mitth. der Oek. Gesell. im Königr., Sachsen*, b. v, 1892-93, 8°, 22 pp.
- SCHNEIDER, A. *Einwirkung des Kantonmänners auf die Regenbildung*: *Petersmann's Mitth.*, Götting, 1892, pp. 112-113.
- SMITH, G. H. *Rain-making by Condensation in the Rocky Mountains*: *Science*, New York, vol. xix, 1892, p. 32.
- TEG, J. H. *Do Hailies cause Storms?* *Amer. Meteorologist*, Saint Louis, vol. 1 number 6, 1870, pp. 138-145.
- THEOPHILUS, JONAS. *Cloud Fires and Rain-storms*: *Pop. Sci. Month.*, New York, vol. 4, 1875, pp. 206-211.
- UNITED STATES DEPARTMENT OF AGRICULTURE. *Letter from the Secretary of Agriculture transmitting a report of the special agent of the Department of Agriculture for making experiments in the production of rainfall*: 53d Cong., 1st Session, Senate Rx. Doc. 45, 8°, Washington, 1892, 30 pp., 9 pls.
- VAN BUREN, ALBERT. *Rain not produced by Condensing*: *Sci. Amer.*, New York, vol. xliii, 1893, p. 102.
- WATSON, J. P. *Rain-making*: *Kansas Academy of Science*, February 12, 1894, 8°, 3 pp.
- WARR, R. DE C. *Artificial Rain*. A review of the subject to the close of 1880: *Amer. Met. Journal*, San Arbar, vol. viii, 1891-92, pp. 484-493.

